U.S.N | | | | | | | | | | |

P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fourth Semester, B.E. - Automobile Engineering

Semester End Examination; June/July - 2015

Theory of Machines - I

Time: 3 hrs *Max. Marks: 100*

***Note**: i)* Answer **FIVE** full questions, selecting **ONE** full question from each **Unit**.
ii) Assume suitable missing data if any.

UNIT - I

1. a. With the help of suitable example and sketch, explain classification of kinematic pairs. 10

b. Explain any two inversions of four bar chain. 10

2 a. Explain with a neat sketch, whit worth quick return motion mechanism. 8

b. State and prove the principle adopted in exact straight line motion mechanism. 6

c. Explain with neat sketch, toggle mechanism. 6

UNIT – II

3. The crank and connecting rod of a steam engine are 0.5 m and 2 m long respectively. The crank makes 180 rpm in the clock wise direction. When it has turned 45º from the inner dead centre position determine velocity of piston and angular velocity of connecting rod. Do the above problem through both relative velocity method and I.C. method. 20

4. A mechanism as shown in Fig. (4) has the following dimensions : OA = 200 mm; AB = 1500 mm, BC = 600 mm CD = 500 mm and BE = 400 mm. Locate all the instantaneous centers.

If the crank on rotates uniformly at 120 rpm. Clockwise, find
(a) the velocity of B, C and D.
(b) The angular velocity of the links AB, BC and CD 20

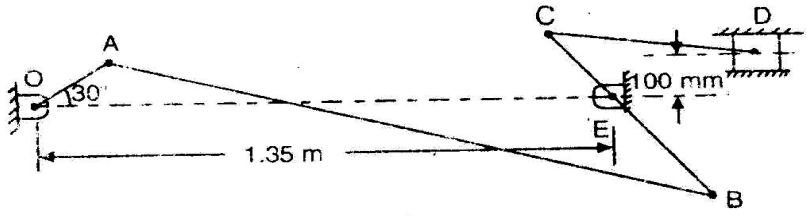

Fig -(4)

UNIT – III

5. PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ = 62.5 mm; QR = 175 mm, RS = 112.5mm, and PS = 200 mm. the crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angles QPS = 60º and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of the links QR and RS. 20

Contd…2

6 a. Explain Coriolis component of acceleration. 6

b. The crank and connecting rod of a reciprocating engine are 200 mm and 700 mm respectively. The crank is rotating in clockwise direction at 120 rad/s. Find with the help of Klein construction;

i) Velocity and acceleration of the piston 14

ii) Velocity and acceleration of the midpoint of the connecting rod

iii) Angular Velocity and angular acceleration of the connecting rod, at the instant when the crank is at 30º to inner dead center.

UNIT – IV

7 a. Derive an expression to the length of path of contact in a pair of involutes teeth. 10

b. A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20º pressure angle. 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and contact ratio. 10

8 a. Explain Reverted gear train. 4

b. Fig. (8) shows a compound epicyclic gear train. Wheel A, D and E are free to rotate independently on spindle O, while B and C are compound and rotate together on spindle P, on the end of arm OP. All the teeth on different wheels have same module. A has 12 teeth, B has 30 teeth and C has 14 teeth cut externally. Find the number of teeth on wheels D and E which are cut internally.

If the wheel A is driven clockwise at 1 r.p.s. determine the magnitude and direction of the angular velocities of arm OP and wheel E. 16

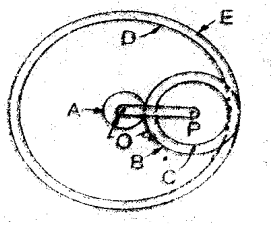

Fig (8)

UNIT – V

9. Draw a cam profile to drive an oscillating roller follower to the specification given below:

(i) Follower to move outwards through an angular displacement of 20º during the first 120º.

(ii) Follower to return to its initial position during next 120º rotation of the cam.

(iii) Follower to dwell during the next 120º of cam rotation. 20

The distance between pivot center and roller centre = 120mm. Distance between pivot centre and cam axis = 130 mm. Minimum radius of cam = 40 mm; radius of roller = 10 mm; Inward and outward strokes takes place with simple Harmonic motion and UARM respectively.

Contd…3

10 a. Derive an expression for displacement, velocity and acceleration for a Tangent cam with reciprocating roller follower when the contact is with straight flank. 10

b. A symmetrical circular cam operating a flat faced follower has the following particulars; minimum radius of the cam = 30 mm; total lift = 20 mm; Angle of lift = 75º, Nose radius = 5mm; speed = 600 rpm.

Find; 10

(i) The principal dimensions of the Cam

(ii) The acceleration of the follower at the beginning of the lift, at the end of contact with circular flank.

* * * * *